APPENDIX D

Highlights of the DoD Technology Transfer Program in FY 2002 and FY 2003

Highlights of the DoD Technology Transfer Program in FY 2002

PRIMARY/SECONDARY CONTAINMENT SYSTEM COMBINATION SYSTEM

The Chemical Biological Explosives Containment System/Workshelter combination is a system designed for the containment and mitigation of chemical explosive terrorist devices and/or small munitions.



CBECS. The primary Chemical system, Biological Explosives Containment System or CBECS, is a pneumatic structure supporting a Kevlar tent with a filling sock for aqueous foam. It is approximately 7 feet in diameter at the base and tapers to about 4 feet in diameter at the top. Once inflated, it is designed to be placed over device/munitions and filled with blast suppressive aqueous

foam. This component will contain/mitigate approximately 70-100% of the blast overpressure, fireball, agent dissemination, and fragments of the device/munitions.

WORKSHELTER. The secondary containment shelter is also an airframe, which is easily inflated and placed over the primary containment system or CBECS. It is approximately 13-feet wide, 10-feet long, and has a height of 8 feet. The workshelter is designed to contain/mitigate the residual effects, primarily escaping fragments and vapors/aerosols from the primary containment system, associated with the detonation of the device/munitions.

MANUFACTURER. ECBC entered into a patent licensing agreement with ZUMRO, Inc., a leader in the life safety industry, to market CBECS to commercial customers. Both the primary and secondary systems were jointly designed by the Chemical/Biological Counterterrorism Team and ZUMRO Inc. and fabricated by ZUMRO, Inc. The company is located in Willow Grove, PA, and can be contacted at (800) 932-6003.

Further information can be obtained by directing your inquiries to Technical Director, U.S. Army Edgewood Chemical Biological Center, ATTN: AMSSB-REN-HD-T/Mr.

James A. Genovese, Aberdeen Proving Ground, MD 21010-5424, by telephone at (410) 436-1915or DSN584-1915, or email mail to jmgenove@apgea.army.mil.

SYSTEM AND METHOD FOR ENHANCED VISUALIZATION OF SUBCUTANEOUS STRUCTURES



Scientists in the Air Force Research Laboratory Materials and Manufacturing Directorate developed a medical breakthrough in the technology to locate veins and arteries in wounded soldiers on the battlefield. The Vein Viewer is a system and method for enhancing visualization of veins, arteries or other subcutaneous natural or foreign structures of the

body and for facilitating intravenous insertion or extraction of fluids, medication or the like in the administration of medical treatment to human or animal subjects. The Viewer is comprised of a light source for illuminating or transilluminating the corresponding portion of the body with light of selected wavelengths and a low-level light detector; such as an image intensifier tube (including night vision goggles), a photomultiplier tube, photodiode or charge coupled device for generating an image of the illuminated body portion, and optical filter(s) of selected spectral transmittance which can be located at the light source(s), detector, or both.

The primary medical application for this new technology is locating veins and arteries. During initial experiments, the research team used only tools that were available—a television remote control infrared light source and standard military NVGs—to clearly see the network of veins in fingers, hands, lower arms, and feet. They performed additional experiments using various light sources and filters to determine the optimum imaging characteristics of the device and to verify that a needle inserted beneath the skin was clearly visible since metal also blocks infrared light. This capability will also help doctors locate foreign objects, such as bullets or shrapnel, under the skin.

In addition to its military battlefield uses, the breadth of the Vein Viewer's technological achievement encompasses a broad range of civilian applications including emergency medical services, trauma centers, blood banks, pediatric and geriatric care facilities, and a variety of surgical procedures. The research

team successfully demonstrated a prototype of the Vein Viewer at hospitals in Ohio—Wright-Patterson Medical Center, Cincinnati Children's Hospital Medical Center, and Columbus Children's Hospital. Many physicians commented that this technology will alleviate a great deal of patient suffering, especially in small infants who must sometimes undergo painful medical procedures requiring access to veins such as drawing blood and IV insertions. Vein Viewer technology should greatly improve medical treatment for premature babies whose veins are often too small to access using conventional procedures. The new technology also allows quick access to arteries for blood gas analysis used to measure oxygen flow from the lungs.

Infrared Imaging Systems (IRIS). IRIS is a start-up company located in Columbus, OH, specifically founded to exploit this technology. The Air Force currently has an exclusive license with them on the original patent and a follow-on CRADA for further developmental work.

Inventors: Robert L. Crane, Byron P. Edmonds, Charles C. Lovett, and Walter E. Johnson, Materials and Manufacturing Directorate, Wright-Patterson AFB OH (US Patent No. 6,230,046)

Other Highlights

<u>Army</u>

The U.S. Army's Cold Regions Research and Engineering Laboratory is the only Federal laboratory with a primary focus on Arctic and cold regions problems and is internationally recognized as a center of excellence in Arctic research. While its research program is designed to be responsive to the needs of the military, a majority of the research and engineering results also benefit the civilian sector.

The U.S. Army's Edgewood Chemical and Biological Command has initiated several MoU/MoA/IAA/ISSA with other Government Agencies and found that while these agreements are not traditionally considered the venue for the Technology Transfer program, significant results were obtained in transferring technologies developed by ECBC for military defense applications to the new Homeland Security objectives, thus resulting in both enhanced public safety and savings.

The Army's NATICK Soldier Center's National Protection Center worked with MIPT for R&D of thermoelectric cooling and battery technologies for future integration into a cooling garment for public safety & emergency response operations.

The U.S. Army's Medical Research Material Command signed a patent license agreement (PLA) for potentially widespread civilian use. The PLA allows for the commercial development by a medium sized US pharmaceutical firm of a topical skin protectant cream for nursing home & hospital prescription use. This cream,

developed initially by U.S. Army Medical Research ICD for protection against chemical weapons exposure, is expected to have additional nonmilitary uses including skin protection against harsh chemicals in the home and in industrial settings, and for protection against such irritants as poison ivy.

Air Force

The Air Force Research Laboratory Directed Energy Directorate (AFRL/DE) signed a CRADA in which Raytheon Company's objective was a joint research effort with AFRL/DE to focus on determining the effects of High-Power lasers on various assets and defining the parameters of a High Energy Laser (HEL) System for tactical platforms. This joint research agreement defines a twenty-four month joint study effort that results in a detailed analysis of asset response to High Power lasers and the suitability of using lasers on tactical platforms to defeat this class of asset. The agreement also studies the system aspects and what it will take in the areas of: Mission Analysis, Laser Technology, Tactical Beam Control, Laser/Target Interaction Modeling, and Effects. Both the Air Force and the Raytheon Company expect to benefit from the relationship and the resulting shared data. The Results of this research will be used as a point of departure for expanding the utility of High Power lasers on various platforms and augmenting the warfighter's capability.

The objective of Lockheed Martin Aeronautics System's CRADA with AFRL/DE was to study, design, and test high power laser weapons and including required power (electrical) on the F-16, F-22, and the Joint Strike Fighter (JSF), Fighter Demonstrator Aircraft, and other aircraft presently manufactured by Lockheed Martin Aeronautics System (LMAS). LMAS is a global enterprise principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products, and services. In addition, they have been conducting independent studies with R&D funds on the use of both lasers and microwave weapons on fighter aircrafts. The Government will obtain valuable F-16, F-22, and other aircraft design details, thermal analysis, and aircraft performance critical to installation of laser weapons on a war fighting aircraft. LMAS will obtain valuable laser weapons technology and information on its applications/efforts to integrate HEL of tactical platforms to advance warfigher's capabilities in the 21st Century.

AFRL/Human Engineering (HE) Directorate signed a CRADA with Veridian Engineering, Inc., for commercial use of the AFRL Manikin Integration Research Laboratory at Wright-Patterson AFB. Veridian Engineering, Inc, has reported revenues for use of specialized manikins and, in accordance with the CRADA, 5% is being contributed by Veridian to upgrade and maintain the AFRL facilities.

AFRL/HE has a second CRADA with Veridian Engineering, Inc., for the commercial use of the AFRL Bioacoustics Facilities at Wright-Patterson AFB. Veridian Engineering, Inc, has reported revenues for the use of specialized acoustic facilities. 10% of this revenue will be contributed by Veridian to upgrade and maintain the AFRL facilities.

The Air Force Research Laboratory Directed Energy and Space Vehicles Directorates have an Office of Technology Transfer for Education (OTTE). OTTE has developed a project on weather service. Pinpoint WeatherNet (PWN) Project is a CRADA with KOB-TV, which provides high quality weather stations for NM middle schools. In FY02, 48 schools participated. AFRL has reached over \$6.2M in promotional airtime. In FY02, PWN became part of the Homeland Security WeatherNet Network, a partnership between the National Weather Service and Automated Weather Source.

Navy

The U.S. Navy's Naval Underwater Weapons Center, at Newport, Rhode Island, signed two patent license agreements in FY 01 with Predictive Technology, Inc. (PTI), a small Massachusetts company formed to commercialize the use of nonlinear signal processing techniques to diagnose or monitor sleep breathing disorders. An issued patent was licensed by PTI which covered the basic concept. An additional patent application was licensed which expanded the concept to a test while a patient is awake. The invention makes it possible to reduce medical and insurance costs by allowing a patient to be diagnosed for sleep apnea in a doctor's office while awake in a 20-30 minute test instead of having to undergo an all night stay at a sleep clinic.

National Security Agency

The National Security Agency has licensed to the Raytheon Company the SilentRunner® product and technology which continuously monitors and analyzes network activity and security performance. SilentRunner® passively gathers data about a network, its structure, its traffic and its users by analyzing raw network packets. The raw packets are assembled and organized in a knowledgebase that provides a detailed activity display of the network. Not only does SilentRunner® provide information on MAC and IP connections, it analyzes the protocols transversing the network, the applications being used (along with the users), website activity and displays an ontological map for easy information access. This level of analysis enables you to assess real-time data for assessing security risks and network vulnerabilities, identifying what is really on your network, and where security breaches might occur. Additionally, SilentRunner® provides 3D visualization capability for viewing very large network diagrams in detail. With the aid of a 6 Degree of Freedom input device you can "fly" through the virtual network looking for anomalous behavior.

Highlights of the DoD Technology Transfer Program in FY 2003 BIOLOGICAL SAMPLING KIT (BiSKit)

Responding to challenges presented by anthrax contamination at the Hart Senate Office Building, Brentwood Post Office, and other sites, molecular biologist Peter Emanuel and engineers Mark Schlein, Kevin Wallace, and Peter Schlitzkus of the U.S. Army Edgewood Chemical Biological Center (ECBC) developed and rapidly produced a new biological sampling kit. The "BiSKit" is a self contained, portable, and disposable biological sampling kit. It provides significant improvement over present methods of collecting samples.

The BiSKit is a single-use kit made of a specially designed two-piece plastic container with a sampling sponge fastened to the lid and a separate dropper attachment. A small vial containing sterile buffer solution attaches to the bottom of the unit to wet the sponge for sampling. The BiSKit allows sampling teams to take multiple samples in rapid succession, while minimizing the potential for exposure to hazardous biological threat agents. The kit has been thoroughly tested and shown to be compatible with chain-of-custody procedures and current biological analysis techniques. A unique feature of the BiSKit is its sample extraction means, whereby the simple process of screwing the lid back onto the container after collecting a sample causes the sponge to be both compressed and scraped against built-in ridges, thus extracting the sample, which flows back into the vial.



Using computer-aided design and rapid prototyping systems, the inventors produced a series of prototypes, each improving upon the other. Arriving at a design that provided significant improvements in biological field sampling, the Invention Evaluation Committee (IEC) review and patent protection process was accelerated. The IEC and patent legal team of John Biffoni and Vicki Upchurch worked concurrently to make patent

protection of the BiSKit a high priority and expeditiously file a patent application. With a solid patent application filed, the technology transfer team of Donna Cannella and Christina Frain assisted with the non-exclusive licensing in April 2003 of the BiSKit to QuickSilver Analytics, Inc. (QS). Patti Riggs and Rodney Hudson negotiated the licensing for QS. QS is a small business with over 4 years of experience in the manufacture, marketing, and sale of the FAC Chemical/Biological Sampling Kit developed by ECBC. QS is teamed with Dave Wheatley of D. Wheatley Enterprises, another small business, for the manufacturing of the BiSKit body. QS is taking the bodies and completing the assembly, sterilization, market distribution, sale, and technical expertise in the different fields of use for the invention. These fields include the Homeland Security sector as well as the traditional food and environmental inspection industries. The QS team has produced several prototype BiSKits and is currently

in full-scale manufacturing to provide 3,000 kits for Homeland Security purposes by various first responder and Governmental entities.

The result is a product that has been transferred to the civilian sector to be produced in large quantities at an affordable price, while meeting strict quality assurance standards required for forensic evidence and scientific merit. The public will benefit from this technology transfer through enhanced public safety and confidence in the results of field sampling for biological agents. The cost savings from avoiding unnecessary closures of public or private buildings and the avoidance of injury or loss of life due to inadequate or unvalidated sampling equipment and techniques are not easily quantified, but clearly immense. This technology, successfully transferred from a Federal Laboratory to the civilian sector in April 2003, provides a critical tool for achieving this critical public safety objective.

GEL-COR, Specialized Ballistic Rubber Media



The Army's Engineer Research and Development Center's Geotechnical and Structures Laboratory (GSL) continued a 2002 CRADA with Super Trap, Inc., of Corona, CA, to improve existing firing range design and materials technology. Super Trap, Inc., a privately held, veteran owned small business, is a leading designer and developer of rifle and pistol shooting range backstops, ballistic baffles, clearing boxes and tactical targets. The

CRADA resulted in a joint invention of a specialized ballistic rubber media called GEL-COR. The CRADA granted Super Trap, Inc., a field of use license to GSL's patented SACON® shock absorbing concrete technology and provides for GSL's technical assistance in efforts to introduce the technology into construction of firing ranges. The new bullet traps will offer environmentally friendly and cost-saving alternatives for both civilian and military firing ranges. In 2003, Super Trap, Inc. signed an exclusive field of use license with GSL to this joint invention of GEL-COR for firing range applications. Trap designs have been developed for use in both indoor and outdoor ranges. They will accommodate not only lead ammunition of all small arms calibers up to .50 caliber, they can also handle lead alternatives such as tungsten or copper based-frangible rounds. Even the Army's "steel penetrator" ammunition can be used with the new trap designs.

PowerStor Aerogel Capacitor







The PowerStor aerogel capacitor offers big electrical storage capabilities in a small package. The capacitor has extremely fast discharge capabilities and low equivalent series resistance, which make it ideal for pulsed power applications. The device has high energy density (100 times greater than electrolytic capacitors) and high power (10 to 100 times greater than conventional lithium batteries). Because there are no chemical reactions, it can be recharged hundreds of thousands of times without degradation. Other advantages include small size, low cost, and reliable operation over a wide temperature range.

The PowerStor aerogel capacitor is based on a novel material called carbon aerogel. Carbon aerogels consist of interconnected nanometer-sized particles with small pores. This monolithic structure leads to very high surface area (the equivalent surface area of 10 football fields) and high electrical conductivity. Capacitors can be made using thin-film carbon aerogel paper as both the positive and negative electrodes. A microporous separator is placed between the two electrodes, creating a sandwich that is wound in "jellyroll" fashion and housed in an aluminum or steel can. The can is then filled with electrolyte and sealed, with protruding leads. When the capacitor is charged, positive and negative ions are oriented along the surfaces of the oppositely charged electrodes. As energy is released, this orientation relaxes back to a disorganized state.

More than 10 million of PowerStor's devices have been sold in Asia, Europe, and the United States, with new applications emerging monthly. One notable customer, Microsoft, uses the capacitor to power the clock in its new X-Box™ gaming console system. Several aviation equipment manufacturers install the device in their aircraft displays to maintain continuous voltage when switching from one electrical bus to another. Other applications include low-tech toys, valve actuators, and insulin pumps. A full line of aerogel capacitors has been designed for memory backup, pulsed power, and main-power applications. Prices range from \$0.25 to \$30 depending on the type and quantity desired.

Cooper Electronic Technologies is selling these devices. The company acquired this technology by purchasing PowerStor, a subsidiary of the now-defunct PolyStor Corporation. PolyStor licensed the aerogel capacitor technology from Lawrence Livermore National Laboratory (LLNL), which originally developed the technology.

Escape Mask Now on Market



A low-cost escape mask is now on the market that uses microfibrous filter technology previously funded by the Ballistic Missile Defense Organization (BMDO; MDA's predecessor) for ballistic missile defense purposes. In its new application for homeland defense, the filter traps toxins and irritants ranging from sarin and anthrax to pollen and dust mites. It is lightweight, foldable, and fits inside a shirt pocket. Small and compact, it can be easily carried and distributed by the hundreds to protect people from harmful air threats. Unlike today's gas masks, the escape mask offers a lower pressure drop so it makes breathing easier—a must for the elderly or young children. The microfibrous technology can be tailored to anticipated threats such as a "cocktail" attack with a combination of chemical agents. It can be recharged simply by being reheated.

The carbon-metal composite used in the microfibrous filter technology originally was developed by Auburn University's Space Power Institute with funding from BMDO's Innovative Science & Technology program. The material would be ideal for use in developing advanced capacitors to power lasers, railguns, and other weapon systems. Fuel cells and batteries made from the material also could provide power for space-based platforms.

The microfibrous filter technology contains sorbent materials in a mesh of carbon-metal composite and cellulose wood fibers that, under a microscope, resembles a wad of chicken wire. This matrix has high electrical conductivity and high surface area (about 1,000 square meters per gram). The fibers are then put through a paper machine on a roll, and the resulting sheets are sent through a furnace at 1,000°C, which melts the fibers and fuses them together. The sheets are then cut into strips and placed in canisters for use in the escape masks.

The escape mask is now available. Initially, it will be distributed to the first-responder market for use in emergency situations, such as terrorist attacks or building fires. Additional microfibrous filter products are being developed. Air security products include a chemical/biological filter for commercial and government facilities. The first air-quality product will be a replacement filter for home use. The target price of the escape amask is less than \$150. Other types of escape masks currently on the market cost more.

The innovator is IntraMicron, Inc. Formed in 2001, the company develops filter products for personal and facility protection, as well as for air quality assurance. It has an exclusive worldwide license for the microfibrous filter technology from Auburn University, where Dr. Bruce Tatarchuk invented the technology. The company recently secured more than \$1 million in early-stage venture funding. It employs seven people and occupies 2,000 square feet of office space in Birmingham, Alabama. A new 14,000 square foot manufacturing facility with office space in Gahanna, Ohio, also has been leased. The company moved into this facility in mid-2003.

Combined Wedge-Flap for Improved Ship Powering: Winner of the Admiral Bowen Award

Naval Surface Warfare Center, Carderock Division

The DDG 51 combination wedge-flap design program was initiated in 1996, when it was rationalized that the design of a stern flap, to be installed behind a transom with a stern wedge, might prove beneficial. This program represented the initial evaluation of a wedge and flap combination, the two being previously viewed as exclusive devices. It was shown, first through model testing, that a stern flap, installed in addition to the hull's existing wedge, could further reduce the powering requirements. The destroyer USS *RAMAGE* (DDG 61) was then retrofit, in 2000, with a prototype stern flap installed behind its existing wedge. At trials, the stern flap reduced powering in the range of 5 to 15%, increased top speed by nearly 1 knot, and produced annual fuel savings of \$195,000.

The U.S. Navy is now making a concerted effort to retrofit (back-fit) stern flaps on many of its existing combatants, and to forward-fit them on new construction classes. There are a total of 89 U.S. Navy ships with stern flaps installed, 78 completed as retrofits, and 11 completed as new construction items. Current U.S. Navy schedules indicate an additional 59 stern flap retrofits and new construction installations. A total of 148 stern flaps will be installed on seven U.S. Navy ship classes. In all, these seven classes' total 178 active ships, indicating that there remain an additional 30 ships eligible, but not yet scheduled, for stern flap installations.

The Coast Guard currently has scheduled 34 *ISLAND* Class patrol boats for stern flap retrofits, and is planning for all forty-nine boats in this class to eventually receive flaps. One stern flap has been retrofit to a *HAMILTON* Class cutter, with recently completed at-sea trials. The U.S. Navy and U.S. Coast Guard commitments, as of this writing, brings the total number of scheduled stern flap installations to 183 units in the U.S. Current annual fuel cost savings derived from 89 U.S. Navy stern flap units now deployed is \$11.9 million / year. Cumulated U.S. Navy fuel cost savings as of this date is \$29.8 million. Potential annual fuel cost savings for 148 scheduled stern flap units is estimated to be \$19

million / year. Potential life-cycle fuel cost savings for the 148 scheduled stern flap units is estimated at \$546 million.

Stern flap performance improvements increase mission capabilities and survivability. Due to the stern flap: the maximum ship speed is increased (0.3 to 2.0 knots); the reduced fuel consumption results in increased endurance and range; the reduced propeller loading results in reduced propeller cavitations and erosion damage, reduced vibration, reduced signature noise levels, and improved habitability. A reduced power and fuel consumption is due to the stern flap which also results directly in reduced exhaust pollutants released into the atmosphere by these ships. Installation of a stern flap on a ship promotes reductions in the emission of carbon dioxide (CO₂), a "greenhouse" gas, which has become increasingly important due to concerns over global warming; nitrogen oxides (NOx), which have been targeted in order to limit the formation of ground-level ozone, a major component of smog; sulfurous oxides (SOx), regulated by the enforcement of maximum sulfur content in fuels; and particulate matter (PM), a human carcinogen.

Engineers Develop First Response Expeditionary (FRE) Fire Vehicle



Engineers at the Air Force Research Laboratory Materials and Manufacturing Directorate have developed a deployable, lightweight vehicle that provides crash and rescue firefighting capability in a variety of mission profiles. The First Response Expeditionary (FRE) Fire Vehicle, developed to meet Air Combat Command

and Civil Engineering requirements, has already established its value during Operation Iraqi Freedom, when several of the units were deployed to protect helicopters, aircraft, tent cities, and other bare base operations. The First Response Expeditionary Fire Vehicle, developed to bridge the gap between flight line fire extinguishers and full-sized crash and rescue fire trucks, is ideal for small aircraft and helicopter crashes, for hot pit refueling, and for tent city or deployed base fire protection. It is designed to provide firefighters with the quick-reaction capability to extinguish small aircraft or structural fires before they become uncontrollable. The vehicle can be operated with minimal training or experience, is virtually maintenance free, and is adaptable to a wide variety of mission profiles and vehicle platforms. In addition, the FRE vehicle is sized to occupy minimal pallet space on a cargo aircraft, and offers reduced water requirements and equipment weight.

Advanced Composites Carry Olympic Hopeful to National Sled Racing Title



Engineers at the Air Force Research Laboratory's Materials and Manufacturing Directorate redesigned the aerodynamic component of skeleton racing sleds raced by world class Air Force athletes envying for positions on the U.S. men's Winter Olympic team. One of the racers, Maj. Brady Canfield,

has since won a bronze medal at the World Championships in Japan and the 2003 U.S. Men's National Skeleton Championship. The redesign effort provided hands-on computer aided design, three-dimensional modeling experience for new engineers at the directorate's Advanced Composites Office (ACO) and resulted in improved lay-up techniques.

ACO engineers used the techniques learned and perfected during redesign of the skeleton sleds to build a horizontal tail advanced technology demonstrator, several elevator skin prototypes for the A-10, and sub-scale composite spars for composite design and manufacturing classes.

New Environmental Control Unit Aids the Warfighter



A new Environmental Control Unit (ECU) has been developed that will provide comfort for US troops and keep vital equipment running smoothly. The new ECU is a field-deployable tent cooler designed to heat or cool military tents under the most extreme conditions. During Operation Iraqi Freedom, tent coolers were used to relieve troops from the 125°F heat of the Iraqi desert, and they were also used in tents where military equipment is stored to protect it

from harsh weather conditions that could degrade performance. The new ECU design came to fruition through a Cooperative Research and Development Agreement (CRADA) between the Propulsion Directorate and Mainstream Engineering Corp, Rockledge, Florida. The unit was successfully tested at Fort Drum, New York, during the Patriot Exercise in June 2003. This ECU is a second-generation prototype and was designed to operate in Nuclear, Biological, or Chemical (NBC) mode or non-NBC mode. The ECU can act as either a heater or an air conditioner and can be operated by a remote control. Compared to previous models that took up to 10% of the airbase deployment weight, the current ECU weighs only 600 lbs. The current design features improved

maintainability, performance, and cost, and the training required to maintain and operate the unit has been simplified. The unit also uses standard commercial parts, and simplicity was emphasized during the design to enhance maintainability and reliability. Moreover, there are no exotic components or materials in the new ECU, and since the unit uses Puron (R-410A) refrigerant, the tent cooler has been deemed environmentally-friendly with no ozone-depletion potential. The ECU is shown on test at the Patriot Exercise.

Aircraft Snow Removal System



For proper aerodynamics and flight safety, snow and ice must be removed from airplanes prior to takeoff. Ethylene glycol and propylene glycol, potentially harmful chemicals, have been used to de-ice airplanes for many years. However, these chemicals, after being sprayed onto the aircraft, typically escape onto the pavement and may run into streams or ground water. Each year in the United States a very large quantity of ethylene glycol is introduced into the environment as a result of aircraft de-icing. In surface waters ethylene and propylene glycol can harm wildlife. Consequently, the Environmental Protection Agency has established limits for these materials in surface water. Airports must retain and dispose

of this glycol runoff. Some cities are installing multi-million-dollar catch basins to contain glycol runoff that must then be disposed of properly.

An Air Vehicles Directorate (AFRL/VA) scientist and an independent inventor, Lee Williams, developed a high efficiency forced air snow remover. Under a CRADA, Dr. Keith Numbers (AFRL/VA) perfected the nozzle design, assisted in the optimization of the overall system design and was awarded a U.S. patent for his inventive results. A second patent was later awarded to Dr. Numbers and Lee Williams as a result of their collaboration. An exclusive license for both Air Force patents was then awarded to Lee Williams, president of Aviation Environmental Compliance, Inc. and, in turn, sublicenses were awarded to Global Ground Support, LLC, and FMC Airport Systems, Inc. These two companies now have competing forced air de-icing vehicles in the marketplace.

Global has also been awarded a multi-year contract by the Air Force for forced air de-icing vehicles.

This system uses compressed air to blow snow and unattached ice off of airplane wings. It then puts a thin film of heated glycol on the cleaned wing to melt any residual ice. Often, the new, forced air technology cleans a wing in a single step, without using any glycol. Even when glycol is required to complete the snow removal process, the amount needed, can be 70 percent less than when heated glycol alone is utilized.

The blower's cost saving impacts every aspect of the glycol life cycle: acquisition, storage, heating, collection, recovery and disposal. Such cost reductions are significant, as glycol sells for \$4 to \$5 per gallon, while it's associated life cycle costs total between \$15 and \$20 per gallon. Removing six inches of snow with just glycol, from one airplane can cost more than \$30,000.

To date, 138 military de-icing vehicles have been delivered to the Air Force, and 40 commercial vehicles have been delivered by Global to the airline industry. All 178 of the Global vehicles use Navistar trucks built in Springfield, Ohio. FMC reports deliveries of 31 vehicles. These deliveries total 209 vehicles.

This page intentionally left blank.